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Recent Implosion Experiments on Nova*

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The National Ignition Facility (NIF) will be the next step in the progression of increasingly large lasers used for the development of indirect-drive laser fusion at the Lawrence Livermore National Laboratory. NIF is predicted to be the first laser facility capable of compressing and heating inertial fusion targets sufficiently that ignition occurs. Recent experiments on the Nova laser facility have concentrated on establishing the physics underlying the NIF target point design. Two classes of implosion experiments will be discussed in this presentation. In the first series of experiments, a capsule has been designed which is as similar as possible to a NIF capsule in terms of hydrodynamic instabilities. These capsules have been fabricated with a variety of surface finishes to allow a demonstration of the degradation of capsule performance with surface finish. These experiments provide a stringent test on our ability to model implosions with large amounts of instability-induced mix of the pusher with the fuel. The main diagnostic for this experiment has been the degradation of neutron yield with increasing surface finish.

Currently planned NIF hohlraums are filled with gas to reduce migration of high-Z plasma into the hohlraum volume. This is needed to control time-dependent asymmetry. A second set of experiments on Nova is investigating the effect of filling the hohlraum with gas on the performance of a capsule. Gas-filled hohlraum experiments have been performed on Nova using methane, propane, and neopentane-filled hohlraums. The gas is confined using thin polyimide or mylar windows. Images of imploded capsules are more oblate in gas-filled hohlraums than in vacuum hohlraums, requiring a change in laser pointing to achieve round images. Capsule performance in methane-filled hohlraums is otherwise not significantly degraded from vacuum performance.

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